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METIS.

Letter from Mr. Graham.

"The enclosed ephemeris of *Metis* is founded on the following set of elements:—

Epoch 1848, May 0·0, Greenwich Mean Time.

	° ′ ″	
M	144 24 39·9	
$\pi -$ ☊	2 28 54·0	Mean Eqx. May 0·0
☊	68 28 44·0	
i	5 35 34·5	
φ	7 2 53·85	
Log a	0·3776688	
μ	962″·7275	

"These agree very fairly with the following places, which were obtained by the aid of my second set of elements. The places are referred to mean equinox May 0·0, and have been corrected for the perturbations of the *Earth*, *Mars*, *Jupiter*, and *Saturn*, from the epoch.

G.M.T.	Geo. Long. ° ′ ″	Geo. Lat. ° ′ ″	Obs.
1848. May 6·5	222 39 31·12	3 44 20·22	31
26·5	218 15 43·00	2 58 40·72	38
June 15·4	215 58 29·13	2 9 30·14	13
July 5·4	216 17 57·54	1 25 10·71	14
26·1	219 4 58·78	0 47 16·92	3

"For the last three observations we are indebted to the Cambridge Observatory.

"The corrections of those calculated by these places are,—

	Long. ″	Lat. ″
May 6·5	0·00	0·00
26·5	−0·15	−0·06
June 15·4	+3·36	−6·54
July 5·4	+1·51	−1·88
26·1	−0·04	0·00

"In calculating the ephemeris I made use of these constants,—

	° ′ ″	
A	160 52 35·4	+1·003 d☊
B	73 21 15·7	+1·011
C	60 7 10·2	+0·889
Log a	9·9982074	−0·08 d☊
b	9·9558466	+0·92
c	9·6418949	−3·55

"d☊ is to be reckoned from 1849, Jan. 1·0.

$$x = ra \sin (A + v)$$

$$y = rb \sin (B + v)$$

$$z = rc \sin (C + v)$$

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"It was my original design to correct the ephemeris for the perturbations; but the orbit is still so uncertain that I judge it better to publish the results as they are than to go over ground which might have to be retraced.

Ephemeris.

Greenwich Mean Midnight.

1849.		R.A. h	m	s	N.P.D. °	′	″	Log Δ
Feb.	1	19	28	26·65	114	13	26·7	0·54469
	2		30	18·34		10	33·3	·54395
	3		32	9·85		7	36·0	·54320
	4		34	1·17		4	34·6	·54242
	5		35	52·28	114	1	29·4	·54163
	6		37	43·21	113	58	20·3	·54082
	7		39	33·92		55	7·3	·54000
	8		41	24·43		51	50·5	·53916
	9		43	14·73		48	29·9	·53830
	10		45	4·82		45	5·7	·53742
	11		46	54·69		41	37·9	·53653
	12		48	44·34		38	6·4	·53562
	13		50	33·76		34	31·4	·53469
	14		52	22·95		30	52·9	·53375
	15		54	11·89		27	11·0	·53279
	16		56	0·60		23	25·7	·53181
	17		57	49·06		19	37·1	·53081
	18	19	59	37·26		15	45·3	·52980
	19	20	1	25·21		11	50·3	·52876
	20		3	12·89		7	52·1	·52771
	21		5	0·29	113	3	50·9	·52665
	22		6	47·42	112	59	46·7	·52556
	23		8	34·27		55	39·6	·52446
	24		10	20·82		51	29·6	·52335
	25		12	7·08		47	16·7	·52221
	26		13	53·04		43	1·2	·52106
	27		15	38·70		38	43·0	·51989
	28		17	24·04		34	22·2	·51870
March	1		19	9·07		29	58·8	·51750
	2		20	53·79		25	33·0	·51628
	3		22	38·19		21	4·8	·51504
	4		24	22·26		16	34·2	·51378
	5		26	6·01		12	1·3	·51251
	6		27	49·43		7	26·2	·51122
	7		29	32·52	112	2	49·0	·50991
	8		31	15·28	111	58	9·7	·50859
	9		32	57·70		53	25·8	·50725
	10		34	39·77		48	45·3	·50590
	11		36	21·51		44	0·1	·50452
	12		38	2·90		39	13·2	·50313
	13		39	43·94		34	24·6	·50172
	14		41	24·62		29	34·2	·50029
	15		43	4·94		24	42·3	·49884

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1849.		R.A.			N.P.D.			Log Δ
		h	m	s	°	′	″	
March	16	29	44	44·89	111	19	48·9	9·49738
	17		46	24·47		14	54·1	·49590
	18		48	33·67		9	58·0	·49440
	19		49	42·49		5	0·6	·49289
	20		51	20·92	111	0	2·1	·49135
	21		52	58·96	110	55	2·6	·48980
	22		54	36·58		50	2·0	·48823
	23		56	13·81		45	0·6	·48665
	24		57	50·62		39	58·3	·48504
	25	20	59	27·01		34	55·4	·48342
	26	21	1	2·98		29	51·7	·48178
	27		2	38·52		24	47·5	·48012
	28		4	13·62		19	42·9	·47844
	29		5	48·29		14	37·8	·47675
	30		7	22·52		9	32·5	·47504
	31		8	56·30	110	4	26·9	·47331
April	1		10	29·63	109	59	21·3	·47156
	2		12	2·50		54	15·5	·46980
	3		13	34·92		49	9·9	·46802
	4		15	6·87		44	4·4	·46623
	5		16	38·37		38	59·0	·46441
	6		18	9·40		33	53·9	·46258
	7		19	39·95		28	49·1	·46073
	8		21	10·04		23	44·8	·45886
	9		22	39·62		18	41·1	·45698
	10		24	8·74		13	38·0	·45508
	11		25	37·36		8	35·6	·45316
	12		27	5·48	109	3	34·1	·45122
	13		28	33·10	108	58	33·6	·44927
	14		30	0·21		53	34·0	·44730
	15		31	26·80		48	35·7	·44531
	16		32	52·85		43	38·6	·44330
	17		34	18·37		38	42·9	·44128
	18		35	43·35		33	48·7	·43923
	19		37	7·77		28	56·1	·43716
	20		38	31·64		24	5·2	·43509
	21		39	54·94		19	16·1	·43299
	22		41	17·66		14	28·9	·43088
	23		42	39·80		9	43·7	·42875
	24		44	1·35		5	0·6	·42660
	25		45	22·30	108	0	19·7	·42443
	26		46	42·65	107	55	41·3	·42225
	27		48	2·38		51	5·2	·42004
	28		49	21·48		46	31·7	·41783
	29		50	39·96		42	0·8	·41559
	30		51	57·81		37	32·7	·41334
May	1		53	15·03		33	7·4	·41107
	2		54	31·59		28	45·0	·40879
	3	21	55	47·51	107	24	25·9	0·40649

Corrected for aberration, but not for perturbations.